Journal of the Society of Arts.

FRIDAY, OCTOBER 16, 1863.

NOTICE TO MEMBERS.

The Council hereby convene a General Meeting of the members of this Society, to be held on Thursday, the Twenty-second of October, at four o'clock in the afternoon, at Burlington House, Piccadilly, for the following purposes :—

1st. To suspend, for this meeting, the Bye-laws relating to the election of members and officers.

2nd. To elect His Royal Highness the Prince of Wales a member of this Society.

3rd. To elect His Royal Highness the Prince of Wales President of this Society.

(By order)

P. LE NEVE FOSTER, *Secretary.*

Society's House, Adelphi, W.C.,
14th October, 1863.

MINING INDUSTRIES AND COAL TRADE OF BELGIUM.

All the mines, quarries, turbaries, fixed steam-engines, metal, glass, and alum works of Belgium are under the supervision of an Inspector-General and eight inspectors, all subordinate to the "Directeur-Général des Ponts et Chaussées et des Mines" in the Ministry of Public Works. They are divided into two directions and eight arrondissements, as follows :—Hainaut, having two arrondissements —Mons and Tournay; Charleroy; the other eight provinces, having six arrondissements—Namur, province of; Luxembourg, province; Liège, left bank; Liège, right bank; Huy; the five northern provinces.

There is, moreover, a body of five members, called "Conseil des Mines," invested with certain deliberative attributes, especially referring to concessions and extensions of mines.

The organisation and taxation of mines is mainly regulated by the laws of the 21st April, 1810, and 2nd May, 1837. All mining operations must be previously authorised by a Royal Act of Concession, which confers perpetual property in all deposits of any specified mineral within a certain defined area on the payment of certain dues to the owner of the land, as well as to the Treasury. The concession is always refused if the existence of the mineral is not proved to the satisfaction of the Council of Mines. If in the process of working another mineral should be discovered, a fresh concession must be applied for. This is generally, but not necessarily, granted to the same "concessionnaire." The tax on mines is divided into the "redevance fixe" and the "redevance proportionelle," the former amounting to 10 centimes per hectare (2·47 acres), the latter to 2½ per cent. of the net produce. Both of these charges go to the Treasury. There are besides two similar charges which vary in different concessions, payable to the owners of the surface; a fixed charge, generally amounting to 1 franc per hectare, and a graduated rate of from 1 to 3 per cent. of the net produce.

There are 82 concessions of metallic mines, and 266 of coal mines, now in vigour. The 82 metallic concessions cover 45,000 hectares; they are worked at 1,256 different points, of which 121 are open-air excavations, and 1,135 are pits. The number of hands employed in all these conceded mines is 11,141. Besides these, about 6,000 or 8,000 are employed in the so-called "free iron mines," which are not included in the above figures. The 82 conceded mines are provided with 104 steam-engines, besides other mechanical appliances for extracting minerals and water.

The principal produce of all these mines are iron ore, pyrites, blende (sulphuret of zinc), calamine (carbonate of zinc), and galena (sulphuret of lead). The quantities of these five minerals raised in 1860 were 927,810 tons, valued at 13,500,000 francs. Besides these, there are certain unrecorded quantities of manganese, barytes, lead, and aluminous schist extracted. A certain quantity of copper is manufactured from imported ore, but none is extracted from the mines. Iron, zinc, and lead are virtually the only metals extracted in Belgium. The produce of the marble, stone, and slate quarries is 17,300,000 francs in value—greater than that of all the metallic mines together, and employs 17,105 hands. If this produce be added to that of the mines and metals, the aggregate wealth created from the mineral produce of the country, still exclusive of arms, machinery, and hardware, would appear as follows :—

	1851.	1859.	1860.
	Francs.	Francs.	Francs.
Metallic Ores	8,078,292	14,061,737	13,576,202
Coal	49,078,181	104,006,201	107,127,282
Metals, glass, and alum	51,070,469	121,207,878	129,699,113
Marbles, stones, and slates	(?)	15,070,444	17,393,574
Total	108,226,942	254,346,260	267,796,171
Total in £ sterling	4,329,076	10,173,848	10,711,844

The above records of mineral produce only include the four southern provinces, in which alone there exist any mines properly so called. The "free iron mines" of the five northern provinces produce a large quantity of alluvial iron ore, but are not the subject of any statistical record. In addition to this unknown quantity, the amounts of hardware, arms, and machinery, fabricated principally from the metallic products of the country, would, if known, form a vast accession to the above totals. On the other hand, it is to be observed that these totals include the same materials twice over, viz., as ores and as metals; and, therefore, that, in order to elicit the net aggregate creation of value, the price of the former raw material employed in the manufacture of metals should be deducted from the gross aggregate. Some of the metallic produce, moreover, such as the steel and copper, are produced from foreign ores, or metals in a crude state, the price of which would have to be eliminated in order to form an accurate estimate of the value actually created in this country.

The aggregate value of all the mining and metallurgical industries recorded for 1860 attained the astounding figure of £10,750,000 sterling, the largest amount ever realised in one year. This shows a considerable advance on the preceding year, notwithstanding the depression of many of these branches of trade, and is really much more than double the amount of 1851, viz., £4,333,000. The mineral produce alone has during the same period risen from 57,000,000 to 120,000,000 francs, showing the great opulence of the country in raw materials as well as in manufactures. Specimens of all these mineral products, including slates, stones, marbles, ores, coal, marl, clays, &c., were sent to the London Exhibition.

The increased export of the principal minerals, metals, and metallic manufactures from Belgium, has been nearly as striking as their increased produce, the amount of value having doubled since 1851. The increase in the quantities of the several articles exported will be found to have been still more remarkable than the increase of values, for most of these goods have declined in the market during the last ten years. The year 1861 has been one of great depression. Some of the principal staples have been less exported, such as coal, nails, rails, hardware, glass, and zinc; while other exports, viz., iron ore, pig iron, wrought iron,

castings, machinery, and arms, have increased. The demand for these two latter articles seems to be insatiable.

Another most conspicuous manufacture is that of zinc. The raw material is derived from several mines in the province of Liege, but most of all others from the celebrated mine of La Vieille Montagne, at Moresnet. The concession originally granted in 1806 extends over 8,500 hectares, of which the greater part is in Prussia, 2,875 hectares are in Belgium, and 305 hectares, including the commune of Moresnet, and the great bed of calamine, form a neutral, or rather a joint territory. At the Peace of 1815, both Prussia and the Netherlands struggled to obtain possession of this prize; but as the question was left undefined, both powers agreed to govern it jointly. It is administered by two "Commissionaires," appointed severally by Belgium and Prussia. The conscription is not enforced. The mine tax is paid in equal portions to each.

The powerful Company of "La Vieille Montagne" possesses numerous other concessions of calamine, lead, pyrites, and coal in different parts of Belgium, Prussia, France, and Sweden. It employed in 1860, 5,627 operatives, representing, with their families, 17,000 individuals, of whom 11,756 live in Belgium or Moresnet. The wages paid by the Society in the same year were 3,638,896 francs. No Company has made greater efforts to ameliorate the moral and material condition of its servants. It has adopted the plan of encouraging their zeal by ensuring to each one, in addition to his fixed wages, an eventual share in the result of his own labour, calculated on the task-work principle, applied either individually, or to the squad of hands attached to each furnace or workshop. It has founded a "caisse de secours," a "caisse de prévoyance," and a savings bank, for the exclusive benefit of its own operatives; built dwelling-houses, churches, schools, butchers' and bakers' shops; organised choral unions, archers' and rifle companies, and an annual festival. Its production of raw zinc amounted in 1860 to the enormous amount of 28,925 tons, principally manufactured at Angleur and Tilff, near Liege. The net profits of the Company, notwithstanding the constant fall in the price of zinc, were in 1860, 3,118,132 francs, allowing a dividend of 25 per cent. on the paid-up capital of 9,000,000 francs, besides liberal allowances to the directors. Their zinc-works at Angleur are the largest factory in the kingdom, and a model of order.

The number of operatives, of all ages and sexes, employed in the mines above and below ground, has increased from 55,861 in 1851, to 89,373 in 1860. The number of accidents has increased in a proportion nearly similar, but has diminished since 1855. The years 1854 and 1855 were marked by a great and sudden expansion of the coal trade, by the employment of many thousand fresh hands, and consequently by a great increase of accidents. As many as 252 were killed in 1855 alone, and only 219 in 1860, though the number of operatives had risen to 89,373.

Most of the accidents are found to occur from falls of the roof, stones, or coal in mines. The next most dangerous enemy of the miner is carburetted hydrogen gas (fire-damp); the number of casualties from this cause alone was 74 in 1855, and 47 in 1860, nearly all fatal. A Belgian engineer, Mr. Mueseler, has invented an improved safety lamp, which is highly praised as having stood the test of many years' experience. Another, Mr. Guibal, has exhibited a process patented by him for ventilating mines, which is now in successful operation here. Another fruitful source of accidents is the cages or "cuffats" used for ascending or descending the pits; these are now advantageously replaced in the best managed mines by the apparatus called in Belgium "waroquère," similar to our "man-engine," and to the German "fahr-kunst." Irrespectively of all these dangers, the life of a collier here is generally short, being often abridged in middle life by a species of phthisis, called in popular language "le charbon sur la poitrine."

Crime is unfortunately very prevalent in the great mining district called the "Entre Sambre et Meuse;" less so in the Mons coal district called the Borinage. It is the natural consequence of a dense and uncivilised population; the high wages of labour attract the women and children to the pits, causing their homes and schools to be neglected. This must lead to demoralisation, ignorance, and crime. The exploits of the "Bande Noire," a numerous association of house-breakers lately brought to justice, disclose a state of great depravation. Some legislative measures are called for to check the employment of women and children in the pits, and to promote the moral welfare of the miner.

Ample provision seems to be made for his material welfare. Of all the 89,373 operatives engaged in this industry, 80,783, or nine-tenths, are affiliated to the "caisses de secours," and to the "caisses de prévoyance." The former are funds established at every mine for the temporary relief of wounded and sick miners; the latter are funds created by the association of all or most of the mines belonging to each of the six groups, for the purpose of giving permanent relief to disabled miners, or to the widows of those killed by accidents, and temporary relief to their children. Affiliation to these latter "caisses" is made a condition of all concessions granted since 1840.

In 1860 there were 325 mines, and 80,783 men affiliated to the "caisses de prévoyance." In these mines the stoppages from the miner's wages are divided into two parts; the first and principal part is paid into the "caisses de secours;" the other part, which varies from ½ to 1 per cent. of the year's wages, is paid into the "caisses de prévoyance." The master contributes to this latter fund an equal sum, in compliance with the statutes of the association; these statutes are sanctioned in every instance by Royal Arrêté. The "caisses de secours" are nominally supported by the workmen alone, but in most of them the masters fill up any deficiency which may be found to exist at the end of the year.

In 1860, the six "caisses de prévoyance" raised a gross revenue of 1,002,067 francs, and expended 751,742 francs; the "caisses de secours" raised 1,011,646 francs, and expended 885,975 francs. The aggregate receipts of the two classes of "caisses" during the same year amounted to 2,013,713 francs, of which 1,330,712 francs proceeded from the contributions of the operatives, 488,397 francs from the masters, 151,580 francs from miscellaneous sources, mostly the interest of money in the funds, and 42,824 francs from state subventions. The aggregate expenditure of both classes amounted, in 1860, to 1,697,718 francs, principally in the shape of pensions, relief to wounded, sick, and infirm workmen, medical fees, medicines, dressings for wounds, and school fees for children. The Mons "caisses de prévoyance" alone distributed, in 1860, 264,475 francs to 1,814 recipients; one half of this sum was given as an "extraordinary relief" to 606 miners severely wounded, a class not legitimate claimants on this fund, the local "caisse de secours" attached to each mine being the proper vehicle of temporary relief.

The wages of pitmen in Belgium average 912 francs per annum, or 3 francs 4 centimes per day, reckoning 300 working days in the year. In Hainaut, a collier earns an average of 969 francs per annum, or 3 francs 23 centimes per day. The average earnings of all ages and sexes employed in and about the mines amounted, in 1860, to 708½ francs, or 2⅓ francs per working day. During the same year the operatives paid on an average 5 francs per head to the "caisses de prévoyance," and 11 francs 48 centimes to the "caisses de secours;" total, 16 francs 48 centimes, or 2½ per cent. of their earnings.

Immense sevices have been rendered by these institutions during the twenty years of their existence. Neither England nor France can show any similar collective associations, extending each over a large group of mines, and calculated to provide for the victims of the most extensive disaster; they have been the fruit of voluntary combinations of the masters, and though sanctioned by decree, have not yet been chartered by legislative Act.

Two other cognate institutions, eminently useful to the labouring classes, viz., the "Caisse Générale de Retraite," and the "Sociétés de Secours Mutuels," have been chartered by laws declaring them "institutions of public utility." The Council of Mines, and all the Boards of the "caisses de prévoyance" have long sought in vain to obtain a similar recognition for the latter, in order to enable them to hold property, sue for debts, receive donations and bequests, and obtain exemption from stamp and registration duties. A Bill was introduced in 1854 on this subject, but was lost in the political crisis of 1857, partly owing to the prejudices excited against the creation of so-called "personnes civiles."

In 1850, the number of coal mines conceded was 254, comprising an extent of 103,966 hectares, and that of the mines temporarily tolerated was 56, covering 26,603 hectares. In 1860, the numbers of the same were respectively 264 conceded mines, covering 114,655 hectares, and 26 tolerated mines, covering 13,372 hectares. Of these 290 mines, only 192 are now worked, showing a considerable reduction on the figures of 1850, and especially on those of 1855. These 192 mines were worked by means of 355 pits, by 955 steam-engines of 47,255 horse-power, and by 78,232 operatives, including 54,700 men, 7,752 women, and 15,780 children.

The production of coal has increased in ten years by 50 per cent, in quantity, and has more than doubled in value, so that in 1860 it attained the amount of 9,610,895 tons, valued at 107,127,282 francs, being an average of 11 francs 14 centimes per ton, about double the price of English coal. There are few tracts in the world so rich in coal as Hainaut. This province possesses every variety, from anthracite, burning without any flame, to the bituminous description called "charbon gras," extremely suitable for making coke, and to the flaming variety termed "fléau," similar to our cannel coal, and much in request for glass furnaces and steam-boilers. The following table will exhibit the names, quantities, and prices of the five different

Statement of the Quantities, Qualities, and Prices of the Coal raised in the three Coal Provinces of Belgium in 1860.

Qualities.	Province of						Whole Kingdom.
	Hainaut.		Namur.		Liege.		
	Tons.	Price.	Tons.	Price.	Tons.	Price.	Tons.
1. Thin coal ("Charbon maigre"), burning almost without flame—							
Large	...	...	...	...	2,106	19·70	2,106
Medium ("Menu gailletteux")	...	...	182,864	6·98	453,043	9·43	635,907
Small ("Terre houille")	22,115	9·13	21,664	6·89	917	9·98	44,696
2. Dry coal, with short flame—							
Large	153,689	14·43	...	...	...	...	153,689
Small ("Menu gailletteux")	639,061	6·83	...	...	...	...	639,061
3. Thin coal, with long flame—							
Large ("Gaillettes")	201,200	23·78	...	...	...	...	201,200
Medium ("Gailletteries")	340,900	22·18	...	...	...	...	340,900
Small ("Menu gailletteux")	1,262,700	9·86	...	...	...	...	1,262,700
4. Bituminous coal ("Charbon gras"), burning with long flame—							
Large	326,310	20·68	...	...	13,862	19·37	340,172
Small	3,427,225	10·45	...	...	499,389	9·13	3,926,614
5. Bituminous coal, termed "Maréchale"—							
Large	16,940	21·38	...	...	32,780	18·87	49,720
Small	1,117,510	11·13	...	...	896,550	10·01	2,014,060
Total, tons	7,507,720	...	204,528	...	1,898,647	...	9,610,895
Total value in francs	86,799,913	...	1,427,536	...	18,906,833	...	107,127,282
Average value per ton	...	11·53	...	6·08	...	9·94	11·14

qualities raised in the kingdom, according to the official classification. The most valuable is the "charbon maigre à longue flamme," found only in Hainaut, and sold at 23 francs 78 centimes per ton (for large coal). All the Namur coal is an inferior "charbon maigre," worth, in 1860, from 6 to 7 francs per ton. The Liege coal is good, but too small. It crops up close to the surface, and is said to have been the first of any in Europe used for fuel.

The three principal coal-fields of Belgium, viz., those of the Couchant de Mons, of the Centre, and of Charleroy, are all situated in Hainaut. The first steam-engine for raising coal in Belgium was established here in 1807 at the colliery of Bois du Luc. Steam-pumps had already been used since 1774. The number of pits was diminished, but the gross produce has steadily increased in this province since 1856. The average price has fallen from 13 francs 46 centimes, to 11 francs 56 centimes per ton. The Charleroy basin is that which now produces the largest quantity of coal. The Mons and some of the Centre coals are, however, much superior in quality, the former for furnaces, the latter for domestic use. The Centre is the most fortunate district of all in possessing pits not subject to fire-damp or water, and a few seams of the greatest regularity, and of the best quality, called "demi-gras." Here are situated the great collieries of Mariemont, Bascoup, and Olive, belonging to one firm, and supplying the capital with the best coal for domestic purposes. The present wholesale price of the best large coal at Mariemont is 24 francs 50 centimes; and that of the mixed coal, called "tout venant," is 14 francs 75 centimes. The three other coal-fields are those of Namur, Huy, and Liege.

One peculiarity of the Hainaut mines is that in certain localities, especially at Fléau, there exist two and sometimes three different concessions in different seams of coal, lying one below the other within the same vertical limits. This accumulation of narrow concessions, some horizontal, others vertical, most of them dovetailed into each other, all of them cramped or crowded together, is a serious obstacle to economical working. In comparing together the profits realised by the three great coal basins of Hainaut the Centre leaves the other two far behind it, as the offi-

cial returns would give it a clear profit of 2 francs 50 centimes per ton of coal raised against 1 franc 48 centimes, and 79 centimes realised respectively by the other two basins of Mons and Charleroy.

The first companies for working collieries in Belgium were formed by the miners themselves. In some mines there are still a few shareholders of this class, but they have generally made way for joint stock companies. The original "Sociétés Civiles" and "Sociétés en Commandite" have again made way themselves for the modern "Sociétés Anonymes," on the principle of limited liability. Many of these were rashly formed in the years 1834, 1835, and 1836, for the purpose of working collieries and iron factories, &c. A short period of artificial prosperity was followed by a long one of real depression. Industry did not recover till 1843, but was again prostrated by the events of 1848. However, a new tide of prosperity set in after 1850, which lasted till the war of 1859. New pits were sunk, thousands of new hands were engaged, large fortunes were realised in a few years. One share in a certain colliery, which, in 1830, used to return 2,500 francs per annum, now brings in 45,000 francs. Some shares, such as the "Produits au Fléau," have paid 30 per cent. dividend, and have sold for four times their original value. Many working men have risen to wealth. One of the most opulent individuals in Belgium, now Bourgmestre and representative of his native town, owes his fortune to successful speculations in these mines.

The exports of coal, which were 1,600,000 tons in 1849, have since then more than doubled, being set down at 3,450,000 tons in 1860. France, of course, took the great bulk of these exports, viz., 1,453,000 tons in 1850, 3,298,000 in 1860, and 3,217,000 in 1861. The French imports from Belgium were three times greater in 1860 than those from England, a fact which, in the face of the undoubted superiority of British coal, can only be accounted for by the differential duties then and still existing in France in favour of Belgian coal. About two-thirds of the Belgian exports to France pass through the two bureaux of Condé and Jenncant, *i.e.*, by the Mons and Condé canal, and by the River Sambre; 630,000 tons more are sent by railway from Mons towards Maubenge. All the above imports paid the entrance duty of 1 franc 80 centimes per ton: some imported by the River Meuse paid the reduced rate of 1 franc per ton, while English coal during the first half of 1860 paid the duty of 3 francs 60 centimes when imported into France by any port north of the "Sables l'Olonne."

The duties now levied in France are 15 centimes per 100 kilogrammes, plus the 2 décimes, making in all 1 fr. 80 centimes per ton on all imports of coal and coke by sea (in French or assimilated vessels) and by land, with the single exception of the zone formed by the departments of the Moselle and Ardennes, in which the duty is only 1 franc 20 centimes per ton. Hitherto but a small part of Belgian exports (139,718 tons in 1860) have found their way over this frontier, but the opening of four new railways connecting Belgium with the above two departments will now admit of a large trade. This preferential zone is probably only intended to last till 1864, but even so it appears hardly compatible with the 19th Article of the Anglo-French Treaty of 1860.

Belgian is now being rapidly supplanted by English coal in the coast towns of France, and by French coal in the departments of the Nord and the Pas de Calais. In the former department, the Anzin coal basin vies with any in Belgium; in the latter, new and productive mines are being worked with great success, and, being connected by rail and canal with Paris, are bringing a new element of competition to this great market, where Belgian coal has hitherto predominated. The department of the Seine alone consumes 1,250,000 tons, of which 1,000,000 is Belgian. Rouen itself, another great manufacturing centre, has been in 1860 about equally supplied by England and Belgium.

Belgian coal being gradually repelled from Paris and the coast, must seek for a compensation in the Eastern and Central Departments of France, especially in the iron district of the Haute Marne, which already consumes large quantities of Mons furnace coal; but the cost of conveyance is still too high. It is true that coal can now be shipped from Mons to Strasburg without breaking bulk, and without paying more than 1 franc per ton in tolls. This canal, however, requires constant repairs, and is too narrow for the usual Belgian boats. On the other hand, the railway is too dear, its charges from Mons to Sermaize being 13 francs 40 centimes per ton, those of the canal boats being 7 francs. Freights from Mons to Paris, in 1860, ranged from 8 to 9 francs per ton; those from Mons to Brussels, from 4 francs to 5 francs 75 centimes. They have since risen. From Mariemont to Brussels, the average freight is 3 francs, but it has now fallen as low as 2¼ francs.

The French Government has done much to encourage the Belgian coal trade by reductions of tolls on canals and railways, by the equalisation of duties on coal and coke, and by the inclusion of the whole department of the Ardennes in the privileged zone paying only 1 franc duty, which zone previously comprised only the department of the Moselle and the River Meuse. It has likewise ordered the purchase by the State, and the opening at mere nominal tolls, of the principal canals of the north of France. Even on these unequal terms the railways can afford to compete with them, and this shows that the canals are now become mere superfluities, which would not pay unless, more or less, provided at the public expense. The Nord Railway now carries coal from Mons to Paris, if sent in a quantity sufficient to fill a train, at 3½ centimes per ton and kilomètre, or at 9 francs per ton for the whole distance (25·8 kilomètres). The reduction of railway freights in France and Belgium is still a great desideratum. I am informed that for very considerable distances the English Companies will transport coal at rates equal to 2½ centimes per kilomètre in summer, and at 3½ centimes in winter. The railway goods tariff in Belgium is still much complained of. It is based on the charges of 5, 4, and 3 centimes per 100 kilogrammes per league on the three different classes of merchandise. Coal, coming under the last class, would pay 7½ centimes per ton and kilomètre. The railway charges from the mines to Antwerp come to from 5 francs 70 centimes to 6 francs 65 centimes per ton, and prevent all attempt to export coal by sea. The railway charge from Mons to Brussels is now 5 francs per ton; less, therefore, than the canal charges. Still the latter conveyance is preferred on account of its being less injurious to the coal.

The imports of coal into Belgium during recent years may be seen in the following short statement:—

Imports from	1851.	1857.	1859.	1860.	1861.
	Tons.	Tons.	Tons.	Tons.	Tons.
England	3	74,686	53,896	42,988	38,704
France	9,038	64,863	54,902	52,865	51,429
Prussia, &c.	957	6,520	1,271	1,151	2,538
Totals	9,998	146,069	110,069	97,009	92,771

The imports of English coal are yearly falling off, so that they are now less than those from France by 13,000 tons. These latter are principally confined to some localities in West Flanders, which are situated nearer to the French mines than to those of Mons. French coal pays a duty of 1 franc per ton. English coal pays 1 franc 70 centimes, but still finds a market at Bruges, Antwerp, and even at Ghent when freights are low, but not so far as Brussels.

During the past year the stagnation of the iron and other trades has had a depressing effect on that of coal. The mildness of the late winter has again weakened the demand, so that the stock at Mons alone had risen in February to 2,250,000 hectolitres in wharf, without counting that lying at the pit mouths. The reports from Charleroy and Liege are similar. Still it does not appear that the men have been thrown out of employment.

ELECTRO-MAGNETIC PHONOGRAPH.

This machine is capable of being attached to pianofortes, organs, and other keyed musical instruments, by means of which they are rendered melographic, that is, capable of writing down any music that is played upon them.

So keenly have musicians at all times felt the extreme tediousness of writing music by hand, and the impossibitity of preserving the most valuable impromptu pieces in their full and flowing beauty, that immediately on the introduction of the pianoforte into England strenuous efforts were made by men of inventive skill to supply the instrument with the means of registering the music performed upon it. "The first pianoforte seen in England was made by one Father Wood, an English monk at Rome, and by him sold to Samuel Crisp, Esq., who sold it again to Fulke Greville, Esq., for one hundred guineas."* This was about 1757.

The Rev. — Creed would appear to have been one of the first, if not the first, to think of constructing a melographic instrument, and in the year 1747 he sent to the Royal Society a paper, entitled "A demonstration of the possibility of making a machine that will write extempore voluntaries, or other pieces of music, &c."†

There are also obscure accounts of a machine made in 1770, by a monk named Engramelle.

In a German work of 1774, John Frederick Unger, a counsellor of justice at Berlin, claims priority of invention against Mr. Creed, though it seems most probable that each made a similar invention unknown to the other.

There is no doubt whatever that the Académie of Berlin was presented by Hohlfield—an ingenious mechanic who received some suggestions from Euler—with a machine which, to a limited extent, answered its purpose. It consisted of two cylinders moving paper between them, on which, by means of a crayon, each key made a mark when pressed down in the act of playing. But not only was the action of playing very fatiguing, but the music must have been of a most inconvenient width—that of the key-board—and without any stave, accidentals, &c.; it fact, a mere series of dots showing such and such keys were pressed down in the course of the performance, but utterly failing to mark the time, key, or accidentals. The Académie, however, in consideration of the great ingenuity of the contrivance, rewarded the inventor with a handsome gratuity.

In 1827, M. Carreyre made trial, before the Committee of the Fine Arts of the Institute of France, of a melographic piano, which consisted of a clockwork movement, which unwound from one cylinder to another a thin plate of lead, on which were impressed, by the action of the keys of the instrument, certain peculiar signs, which might be translated into the ordinary notation by means of an explanatory table.

"After the experiment, the plate of lead was removed, to make the translation, and a commission was appointed to report; but as no report was ever made, it is probable that the translation was not found to be exact. At the same time M. Baudouin read before the Institute a paper, accompanying it with drawings, concerning another melographic piano; upon the merit of which we do not find that the Institute pronounced."‡

These accounts prove two important facts; the great efforts made and the small success achieved—this want of success proceeded from the lack of a proper motive power, none having used electro-magnetism—for it must be evident to all acquainted with music that these were as yet nothing more than partially successful experiments, and produced no further results than stimulating inventors to continued exertions.

The causes of failure were many, the most serious being the oversight of endeavouring to derive the mechanical power from the keys of the piano, whereas some power, which, while depending upon the action of the key for its liberation and manifestation, should at the same time exert its force without strain upon the key, still remained a desideratum. Such a power is electro-magnetism, as the mere motion of a piano key, without any alteration in the touch required—may be *made to* call forth a force of any magnitude required. Now, in Unger's machine the power was derived from the keys alone, and by direct action, thus rendering the touch of the piano so heavy that no one could perform properly upon it. For this reason it is unnecessary to consider further its defects. M. Carreyre's, besides being equally objectionable on the score of its unavoidably heavy touch, and arbitrary and unmeaning signs, produced at the best but an indented sheet of lead, a medium for writing music on most inconvenient and unmanageable.

A machine which should register in plain black and white on common paper the music performed, giving the score on the ordinary stave, using the flat, sharp, and natural signs, as in all modern music, accurately registering time, bars, legato and staccato, 8va, alto, and basso passages, and adapted to all keys, still remained a desideratum, for from 1827 to 1863 no further progress was made, though many continued to give their attention to the subject.

But in 1863 Mr. Fenby applied electro-magnetism, and a machine was patented by him, January 13th, in that year, which, without altering the touch or appearance of an ordinary piano, is stated to be capable of registering the most complicated music.

Before giving any detailed description of the construction and capabilities of the phonograph, it may be well to point out the obstacles to be overcome in the notation, and thus to separate the possible from the impossible.

The most obvious difficulty—and one which if not overcome would render all other excellencies nearly, if not quite, futile—is the means of marking the various durations of the notes from the breve to the demisemiquaver, &c. This was a difficulty, inasmuch as the ordinary open, closed, and tailed notes cannot possibly be rendered available in an instrument registering that which is performed upon it.

The following considerations will render this apparent. The longest note is practically but the fusion of a number of shorter notes, from which it follows that on any particular key being depressed, as in playing, its first touch would be the shortest note of the notation, and the machine would immediately print such shortest note, and could not afterwards alter it; for to suppose a piece of machinery to render shorter or longer notes by arbitrary signs, having but a fictitious relation to their duration, is to suppose its possession of a reasoning power, the absurdity of which needs no comment. From these considerations, and others which will readily occur to the mind of the reader, it is manifest that some system is required in which the duration of sound and the performance of the printing may be co-existent, and thus produce a complete reciprocity of action between the two. In other words, a short note must be capable of becoming a long one in the printing as in the playing.

Bearing these facts in mind will lead to a complete comprehension and appreciation of the system. Each note shows the portion of time occupied in playing it by the length it occupies in the bar, and consists of a horizontal black line proportionate in length to the duration of the note, while the rest of the notation needs no comment, it being in all respects identical with that at present in use.

Having considered the notation, the next thing to which our attention will naturally turn is the mechanical appliances employed to produce this notation. First, then, as to the touch of the piano: this remains, to all intents and purposes, the same as if without the phonograph attached, as the mechanical power is not derived

* Rimbault's History of the "Pianoforte."
† Phil. Trans. vol. xliv., p. 445.
‡ Rimbault.

from the motion of the keys, but from a voltaic battery; the only part performed by the key being to bring a small brass stud, on its under side, in contact with a slender spring; this causes an electro-magnet to bring a tracer against the paper which is continually moving at a fixed rate and thus marks the note. When the key is no longer depressed, the tracing ceases, and the rod slides back; this mechanism being capable of registering the slowest or most rapid playing. The accidentals are printed by revolving type, acted on by the same sliding-rod and magnet. The accidentals are adapted for all keys, so that any number of flats or sharps may be correctly registered; the machine being capable of distinguishing accidentals, flats, sharps, and naturals from those which are proper to the key in which the music may be pitched. That is to say, if the key of A natural be used, F, C, and G, when played sharp, will have no sharp sign in the body of the music, whereas if the naturals of these notes be struck, or the sharps of any others, suitable accidentals will be printed.

Having now reviewed the notes and signs proper to them, the bars will be considered. The barring of the music is performed in a simple manner, precluding the possibility of derangement, and is yet so accurate in adjustment that it correctly follows the accentuation of the most complicated piece of music. When a rallantando movement occurs, the bar or bars through which it runs will be actually lengthened in such a proportion as will accurately denote the character and expression of that part of the music. The same manifest advantages occur in the matter of legato and staccato movements.

The machine requires only blank paper, as it rules the stave and prints the score simultaneously. The inventor furnishes a small battery of convenient and simple form. The charge consists of sulphate of copper and water: one charge lasting for some months. The whole is in a neat drawer at the bottom of the machine, and offers nothing of difficulty or unpleasantness in its management, and requiring to be touched only to supply water to it.

BRITISH ASSOCIATION, NEWCASTLE-UPON-TYNE, 1863.

Remarks on Armour Plating for Ships. By Captain Douglas Galton, F.R.S.

The earlier experiments made on iron plates showed that 4½-inch plates at least were necessary to resist shot. This thickness of iron still leaves the plate liable to be bent or fractured, and knocked off even when not directly penetrated, and the extent to which it would thus suffer will to some extent be regulated by the character of the backing.

The plan adopted in the Warrior target is simply that suggested by the idea of bolting a plate of iron to the side of a wooden ship. The iron skin of the Warrior is covered with two layers of teak planking, each 9 inches in thickness, the one horizontal, the other vertical, and outside of these is the armour plate, 4½ inches thick, secured by bolts screwed up with nuts inside of the ship. The armour in this case is generally considered to consist of two distinct parts—the plate and the backing—but practically there is only the plate. The backing prevents the injuries sustained by the plate from being communicated immediately to the ship, but it affords no effectual support to the plate itself; for, supposing each square inch of timber surface to be capable of sustaining a pressure of one ton, the area of a 68-pounder shot would give a support of about 50 tons to the armour plate, but the work in this projectile at 200 yards range, with the regular service charge of 16lbs., is 2,565,000 foot pounds, or about 1,150 tons, so that at best the timber is only capable of sustaining 5 per cent. of the blow, leaving 95 per cent. to fall to the share of the armour plate, hence the plate at the point of impact is driven into the yielding backing, and the distant parts or edges of the plate are bent outwards, wrenching it away from its fastenings. The fastenings torn asunder are destroyed, and those under, or in the immediate vicinity of the blow are, if not broken, rendered comparatively useless, because the crushing of the backing reduces the space between the plate and the ship's side. But the most severe test to which any target has been subjected at Shoeburyness is far less severe than the ordeal ships would have to withstand in defending the entrance of, or in forcing a passage into, a harbour. At the trial of the Warrior target already referred to, the nature and extent of the test to which it was subjected was as follows:—29 rounds in all struck the target, embracing a total weight of 3,336 lbs. of metal, propelled by 400 lbs. of powder, and representing an amount of work done in foot pounds of 62,570,000. Of this total, however, 32,392,000 goes to the credit of shell and solid shot at low velocities, which are held to be almost innocuous against such targets as the Warrior. Of the thirteen rounds of solid shot at high velocities four only were 68-pounders (and one of these is said to have missed the target), representing work done to the extent of 10,260,000 foot pounds, about one-sixth of the total work, and if one round missed, as alleged, one-eighth; thus, three out of the 29 rounds go to the credit of the old 68-pounder, which is said to be the most effective gun in the service against iron plates. Of the 29 rounds not more than five or six were fired in salvo, and yet the plates were deeply indented, buckled, and badly fractured, and many of the fastening bolts were broken, so that, had the target been part of the side of a ship rolling on the sea, the plates would probably have fallen off in consequence of the destruction of the fastenings. But the strain in such a test as this is far less than that from a well concentrated broadside such as the crew of every French ship is regularly exercised to give.

The next class of targets to which I shall refer had a rigid backing. These targets were composed wholly of iron.

Mr. Hawkshaw proposed one consisting of a thick front plate backed by a series of thin plates secured by rivets. Mr. Scott Russell proposed a most ingenious arrangement, by which the strong front plates were kept in position without any rivets or bolt heads being exposed; others were also tried.

The trials of these targets have tended to demonstrate that a perfectly rigid backing is not desirable; indeed, if we argue from analogy, such a result would have been seen from the first. The permanent way of a railroad is subject to blows from heavy weights moving at high velocities. In the infancy of railways the rails were laid on large stone blocks, and even on solid walls of masonry, but it was soon found that on these rigid roads the rails and carriages suffered far more severely than where an elastic road of sleepers on ballast was used, and the rigid road has long since been abandoned.

The arrangement required for the armour-plating of a ship is a strong front plate, in which deflection under blows shall be prevented, but which shall have some cushion behind to prevent the full concussion of the blow being communicated to the side of the ship.

The best form in which to distribute material in a beam so as to prevent deflection, is to obtain depth; hence, in tubular girders, the top and bottom flanges are separated by a comparatively light web.

Without exactly comparing the effects of the blow of a shot to the weight on a beam, it is apparent that as the best form in which to place the material to resist shot is that which will allow of the smallest yielding at the point of impact, it follows that after reserving a sufficient force of metal for the front plate, the remainder should be placed in that shape which is resorted to for obtaining stiffness in beams.

The target to which I wish to draw attention is constructed on these principles. It has the metal placed in a form suited for resistance, and it has a cushion of wood interposed between the target and the ship. This

target was invented by Mr. Chalmers. When submitted to the Admiralty it was refused to be allowed to be made at the government expense, but Sir Morton Peto was so satisfied with the principles upon which the target was proposed to be made, that he assisted Mr. Chalmers in bringing it to trial by constructing it entirely at his own expense.

It will be seen that this target consists of—1st, a thick front plate as the top flange of a beam; 2nd, of ribs to support it as the web of a beam; 3rd, of a plate of iron to hold up the ribs as the bottom flange of a beam, and that the ribs are themselves supported laterally by timber to prevent their lateral deflection. Between this and the side of the ship a cushion of timber is interposed.

This target underwent a similar trial to the Warrior target, and the result partly confirmed the anticipations formed. The bolts and plates were not fractured, and the ribs were found to have supported the plate so satisfactorily as actually to have been driven a quarter of an inch into it at the parts where indentations on the front took place. It is in fact the best target which has been tried.

The Warrior target has 18 inches of timber and 4½ inches of iron outside the skin of the ship, or 360 lbs. to a square foot.

On Mr. Chalmers' principle this weight allows of 3¾ in. armour plate, half inch for each rib, one inch for the back plate, and 1¼ inch for the timber cushion.

As regards cost, Mr. Chalmers' plan would have enabled 200 tons of the front plate coating, from £40 to £50 a ton, to be replaced by iron of from £15 to £20 a ton for the ribs and back plate.

It is not intended to be suggested that this form of target is perfect, but that it is in this direction that experiments for devising the best form of armour plating should be made.

PROGRESS OF AMERICAN MANUFACTURES.

The Superintendent of the United States Census, in his preliminary report, states that the increase of printing presses in the book and newspaper manufacture has been great beyond all precedent, and has exerted the most beneficent influence by cheapening and multiplying the vehicles of instruction. Its effects are everywhere apparent. Never did an army before possess so much of cultivated intellect, or demand such contributions for its mental food as that now marshalled in its country's defence. Many of these reading soldiers ripened their intellectual tastes during the last ten years. In fact, many divisions of our army carry the printing press and type, and the soldiers issue publications and print the forms for official papers. The press is, indeed, the great prompter of enterprise. It constantly travels with the emigrant to diffuse light and intelligence from our remotest frontiers, where it speedily calls into existence the paper-mill and all the accessories which it supports in older communities.

In New England, the Middle and Western States, the value of book, job, and newspaper printing is returned as 39,428,043 dollars, of which eleven millions' worth consisted of books, the value of the latter being nearly equal to the whole product of the same branch in 1850, which was returned at 11,586,549 dollars. The manufacture of paper, especially of printing paper, has increased in an equal ratio, the State of Massachusetts alone producing paper of the value of 5,968,469 dollars, being over 58 per cent. of the produce of the Union in 1850. New York returned paper of the value of 3,516,276 dollars; Connecticut, 2,528,758 dollars; and Pennsylvania, 1,785,900 dollars.

The sewing-machine has also been improved and introduced, in the last ten years, to an extent which has made it altogether a revolutionary instrument. It has opened avenues to profitable and healthful industry for thousands of industrious females to whom the labours of the needle had become wholly unremunerative and injurious in their effects. Like all automatic powers, it has enhanced the comforts of every class by cheapening the process of manufacture of numerous articles of prime necessity, without permanently subtracting from the average means of support of any portion of the community. It has added a positive increment to the permanent wealth of the country by creating larger and more varied applications of capital and skill in the several branches to which it is auxiliary. The manufacture of the machines has itself become one of considerable magnitude, and has received a remarkable impulse since 1850. The returns show an aggregate of 116,330 machines made in nine States in 1860, the value of which was 5,605,345 dollars. A single establishment in Connecticut manufactured machines to the value of over 2,700,000 dollars, or nearly one-half of the whole production in that year. During the year 1861 sewing-machines to the value of over 61,000 dollars were exported to foreign countries. It is already employed in a great variety of operations and upon different materials, and is rapidly becoming an indispensable and general appendage to the household.

Among the branches of industry which have been signally promoted by the introduction of the *sewing-machine* is the manufacture of men's and women's clothing for sale, which has heretofore ranked with the cotton manufactures in the number of hands—two-thirds of them females—and the cost of labour employed. The increase of this manufacture has been general throughout the Union, and in the four cities of New York, Philadelphia, Cincinnati, and Boston, amounted in value to nearly forty and one-quarter millions of dollars, or over 83 per cent. of the product of the whole Union in 1850. The manufacture of shirts and collars, of ladies' cloaks and mantillas—a new branch which has received its principal impulse within the last ten years—and of ladies' and gentlemen's furnishing goods generally, form very large items in the general aggregate of this branch. They severally employ extensive and numerous establishments, many of them in our large cities with heavy capital. In Troy, New York, the value of shirt collars alone annually manufactured is nearly 800,000 dollars, approximating in value to the product of the numerous and extensive iron founderies which have been a source of wealth to that city.

The influence of improved machinery is also conspicuously exhibited in the manufacture of sawed and planed lumber, in which the United States stands altogether unrivalled, as well for the extent and perfection of the mechanism employed as the amount of the product. This reached, in 1850, the value of 58,521,976 dollars, and, in 1860, 95,912,286 dollars, an increase of 64 per cent. in the last decade. The western States alone, in the latter year, produced lumber to the value of 33,274,793 dollars, an increase of 18,697,543 dollars, or 128 per cent., over their manufacture in 1850. The Pacific states and territories produced to the value of 6,171,431 dollars, and the southern 17,941,162 dollars, a respective increase of 3,841,826 dollars and 9,094,686 dollars in those sections, being a ratio of 162·7 and 102·3 per centum.

OSTREOCULTURE AND PISCICULTURE IN FRANCE.

Among the different parts of the French littoral which have more particularly attracted the notice of the government, the "Bassin d'Areachon," situated on the Bay of Biscay, and in this department, may be cited as particularly favourable to the production of oysters.

This bay, which receives the waters of the Atlantic, has been, from time immemorial, celebrated for its oysters, known by the name of *gravettes*. The nature of the ground, composed of sand and mud, extending over a surface of about 100,081 acres, but of which 2,965 acres only are available, is well adapted to the breeding and to the development of this shell-fish. But owing to the latitude allowed to the fishermen, and the supineness of the maritime authorities, the bay had become almost entirely de-

populated. This state of things at length awakened the attention of the Government, and in 1854, oyster-fishing in the Bay of Areachon was forbidden, and the interdiction remained in vigour till the close of 1859. The result was excellent, for where, in former years, barely the sum of 1,000 francs had been produced, the result of the first year's fishing, after its re-opening, produced to the fishermen upwards of 230,000 francs independently of the private concessions.

The ground being the property of the state, the Minister of Marine determined to make experiments on a portion of it, and in 1854 two beds, of the extent of 53 acres, were prepared and gradually stocked. Concessions of ground were also granted to private industry for the same purpose, when in 1859, M. Coste, who had previously acquired some celebrity from his theory of pisciculture, visited the bay, and induced the inhabitants to believe that they had an inexhaustible source of wealth within their reach. The maritime authorities, jealous of his interference, and convinced from experience of the exaggeration of his statements, wisely endeavoured to moderate the ardour of speculation, by stringent regulations.

From their researches and experiments they had ascertained that only a portion of the ground was adapted to the breeding of oysters, and this, with few exceptions, they determined should be reserved for the special benefit of the fishermen, upon the principle that the maritime population on whom the service of the state fell so heavily, were alone entitled to derive all possible benefit from the fruits of the sea. A portion of the ground which is unfit for breeding, is well adapted to the development and to the fattening of the oyster, and these are the grounds upon which concessions are granted.

Up to the end of 1862, 110 concessions, averaging each about ten acres, had been made, subject to certain conditions, of which the following are the most important:—

The concession to be unlimited, but revokable at any time, and subject to an annual payment of 80 francs to the institution of the "Société de Secours Mutuels de Notre Dame d'Areachon."

To lay down during the first year, at least 20,000 oysters, in each hectare of ground conceded, and 4,000 during the following five years.

To enter into an engagement to try all the experiments that may be recommended.

The two beds belonging to the state have been in full produce for several years. This is estimated at about 2,000,000 a-year; the greatest portion is disseminated over the least productive part of the breeding ground in the "Bassin," and the rest is sent to different points, according to the instructions of the Minister of Marine, but hitherto those oysters sent to Cette and Toulon have not succeeded.

In addition to the native oyster, others from different points have been introduced, particularly from Noirmoutiers, Britanny, England, and Spain. In 1860, about 500,000 were imported at the suggestion of Monsieur Coste, for account of the state, from Marennes. The expenses of these two beds amount annually to about 100,000 francs, namely, for the cultivation, 20,000; for a guardship, 80,000 francs; but this last item is not exclusively for the benefit of the state, as the crew, 60 in number, are occasionally employed to protect the various fisheries, and to serve as a police.

The cost of a private concession of about 10 acres, was at first estimated at 6,000 francs for the first year, and 2,000 francs for each succeeding year, according to the system of cultivation advocated by M. Coste; but these calculations differ greatly from those of the maritime authorities, who are of opinion, that with an annual outlay of 1,300 francs (not including the first necessary outlay for materials, which may be estimated at 500 to 600 francs independent of the purchase of oysters for stocking the bed), a very fair profit may be obtained from the same ground. But where capital is forthcoming, much greater results may be attained by an intelligent employment of it.

On the concessions which are only adapted to the development and fattening of the oyster, the principal expense consists in the purchase of the small oyster. On the best ground it takes from eight months to a year before these are marketable. On those grounds more particularly fitted for the production, the returns are slower, as it requires from two to three years before the oyster attains a size at which it can be lawfully sold, but then even it is not fit for consumption, and must pass into the fattening beds. But once the first outlay in stocking is made, as the reproduction is very great, the chief expense consists in keeping the beds in proper repair, and in favouring the multiplication by artificial means.

The few concessions which combine the two qualities, naturally give the greatest profits, and can, consequently, afford a greater outlay of capital.

During the oyster season of 1862-63, the number of 15,097,000 oysters, which produced 141,967 francs, were bought of the fishermen to stock the beds. These oysters were taken on the various parts of the bay left open to the fishermen.

During the same period, the quantity of oysters fit for consumption, taken from the whole of the conceded beds, amounted to 16,357,000, producing, at the average price of 24 francs the 1,000, the sum of 392,568 francs. These were sent to different parts of the country.

The local consumption may be estimated at about 1,000,000, of the value of about 23,000 francs, making a total of 17,357,000 sold from the 110 conceded beds.

From the year 1856 up to 1860, about 13,000,000 of foreign oysters, in 41 vessels, were imported into the Bay of Areachon, averaging in the former year 18 to 20 francs the barrel of 5,000; but in the latter, the price had risen to 25 francs in consequence of the great demand.

On the unreserved part of the bay, the results of the oyster fishing for the season of 1862-63, was not as satisfactory as in the two preceding periods, for in 1860-61, 19,900,000 were caught; in 1861-62, 18,105,000; and in 1862-63, only 15,097,000. This falling off may be attributed to unpropitious seasons. But it must be remembered that, from 1854 to 1859, scarcely any oysters had been taken from the bay; that their multiplication had made great progress during that interval, consequently it is not surprising that the take should have been greater the first year after the re-opening than in subsequent years. It is, however, expected that when once all the conceded beds are in full bearing, and the open breeding places well stocked and protected by wise and well-enforced regulations, the Bay of Areachon will yield annually a much larger supply.

On the other hand, as regards the conceded beds, the returns show, that a great improvement took place in 1862-63, as compared with 1861-62, the number being 17,357,000 as against 7,500,000.

The increase of the latter period is explained in the following manner:—In 1861-62, only 20 private beds, which composed the original concessions, took part in the sale; the remaining 90, which were granted in 1860, took little or no part. These latter, however, had absorbed the greatest portion of the 53 millions of oysters caught in the bay in 1860, 1861, 1862, besides 13 millions from abroad; and as the oyster cannot advantageously be kept beyond a certain time on the beds, it was necessary in the course of 1862-63 to clear off a certain quantity, this, combined with the desire to get back some part of the capital expended, will account for this great increase.

The importation of foreign oysters is not likely to increase much, unless the native should fail, for it has been remarked that the former are inferior in taste and quality to the latter, though it is believed that in the course of time they will become assimilated with the native kind.

The theory of M. Coste, that the propagation of fish by artificial means can be effected, does not appear to

be adopted by the maritime authorities at Bordeaux, for although he proposed to the Government to form reservoirs for the purpose in the Bassin d'Areachon, no steps have as yet been taken to carry out his views, nor does there appear to be any disposition to commence such an expensive and problematic undertaking. A few private reservoirs have existed for many years, where two or three of the common kinds of fish are kept, which serve to supply the market when the tempestuous state of the weather will not allow the fishermen to venture out to sea.

The present prosperous condition of the oyster fisheries in the Bay of Areachon seems to be mainly owing to the intelligent solicitude of the maritime authorities, and the intervention of M. Coste seems not to have attained those extraordinary results predicted by him. On the favoured spots, and with a good direction, there is no doubt a great increase may be obtained by the old and long tried mode of cultivation, but on those only, for hitherto the artificial means introduced by M. Coste have failed in rendering productive all others. Practice and experience, in this instance, are evidently superior to theory.

Proceedings of Institutions.

Birmingham and Midland Institute. — The last annual report says that, at the commencement of the year, in consequence of a circular which had been issued by the late President, Mr. Arthur Ryland, there was a considerable accession of members, the number being increased to 710. There are at present 687; and, in addition to this, 42 students qualified to avail themselves of the privileges of the general department, making a total of 729, which is an increase of 26 on the number at the close of last year. During the year twenty-nine lectures have been delivered to the members. The number is rather smaller than usual, the delivery of one or two of the lectures which had been announced having been prevented by unforeseen accidents. Four of them, namely, that by Mr. Wiggin, on "Agricultural Chemistry and its Practical Application;" and three by the Rev. W. Campion, on "Astronomy," were given gratuitously. The number of visitors to the Museum has increased from 2,081, in 1861, to 2,385 in 1862. It is frequently visited by persons simply with a view to assist them in their reading. Probably if the advantages it offers were better known to those who have the care of the young, the museum would be made of much more use than it is at present. The meteorological observations have been continued during the past year, and a complete record of the strength, direction, and velocity of the wind, together with the amount of rain-fall, for each hour of each day, is preserved. A reading of the barometer is also taken at nine a.m., daily. In the last annual report the Council invited additions to the Gallery of Art, and some very valuable ones have been received. Mr. Lines has lately presented his picture of "Llyn Idwal;" a gift of no slight value, not only from its intrinsic merits, but from the universal respect and esteem in which the artist is held in Birmingham. A short time since the Warwickshire Drawings, a series of drawings and sketches of great ability by artists of eminence, illustrating the scenery of this county, were advertised for public sale. It was obviously desirable that the dispersion of this interesting collection should be avoided, and the Council desire to record their obligation to Mr. Jaffray and other gentlemen associated with him, by whose public spirit and generosity the whole series has been secured, and handed over to the Institute. The Council have also the pleasure of recording that an offer has been received from Mr. Roden to paint for the Institute a portrait of Sir Francis Scott. The Specification Library has received numerous additions during the past year. It has been attended by 578 persons in 1862, as against 506 in 1861, showing an increase of 72. The Council have devoted a great deal of attention to the industrial department during the past year, being deeply impressed with the desirability of increasing its efficiency and extending its operations. The commencement of several new classes has been pressed upon them; amongst others, classes for the study of the Latin and Spanish languages. The Council, however, have determined that it is not desirable, at present at all events, to establish classes for instruction in those subjects. They feel that their primary object should be to develop, as far as possible, their system of instruction in the different branches of science, and that the absence of a class for practical or theoretical mechanics was a serious omission which they were bound to supply at the earliest practicable moment. They have now completed arrangements for remedying this defect. They gratefully acknowledge the kindness of the Rev. T. N. Hutchinson, who has complied with their request that he would undertake the conduct of such a class, and has added to the obligation by making his services gratuitous. With a view to meet in some measure the demand for instruction in languages, the Council, at the request of many persons, decided in the spring of the year to establish a class for the study of German, and secured the services of Dr. Dammann as teacher. The experiment has so far proved satisfactory, the attendance having been very good in both the terms during which the class has been in existence. On the whole, the attendance at classes during the year has been fully equal to the average of previous years. With a view of accommodating those of the students who have time to spare in the evenings, the Council have caused one of the rooms to be opened for an hour each evening as a reading-room for members of the classes. In the spring an offer was received from G. Harris, Esq., the Deputy-Judge of the County Court, to deliver a course of penny lectures, on Saturday evenings. A few lectures, of a very interesting kind, were delivered by Mr. Harris, but the attendance was not found to be large enough to justify the continuance of the course. The income and expenditure accounts for the past year show that the expenditure has exceeded the income by the sum of £59 18s. This result has chiefly arisen from the unusually small receipts for admission to lectures, and an exceptional outlay on repairs. The income in the general department amounted to £741 10s. 3d., and the expenditure to £652 15s. 5d. In the industrial department the income amounted to £225 5s. 7d., and the expenditure to £373 18s. 5d.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 9th*, 1863.]

Dated 7th August, 1863.

1950. F. G. Mulholland, 36, Essex-street, Strand—Imp. in pipe castings for gas, water, sanitary, and other general purposes, and the introduction of an elastic chemical compound to form expansive joints thereto for prevention of leakage.

Dated 26th August, 1863.

2103. J. Thomas and W. F. Marshall, Shipley, Yorkshire—Imp. in apparatus for spinning.

Dated 31st August, 1863.

2152. A. V. Newton, 66, Chancery-lane—Improved machinery for sawing irregular forms of wood. (A com.)

Dated 17th September, 1863.

2285. J. G. Ulrich, 47, Wellclose-square—Imp. in apparatus applied to railway carriages and trains in order to obtain greater safety to passengers.

Dated 19th September, 1863.

2314. I. de Angelis, 54, Greek-street, Soho—An improved apparatus for obtaining motive power. (A com.)

Dated 21st September, 1863.

2329. C. T. Burgess, 3, Upper Gower street—Imp. in reaping machines.

Dated 22nd September, 1863.

2338. R. A. Brooman, 166, Fleet-street—Certain compositions for preserving cheese. (A com.)

Dated 24th September, 1863.

2350. **A. E. Ragon**, Caroline-street, Bedford-square—Improved machinery or apparatus for stirring or mixing various ingredients or materials to a pasty consistence, said machinery being especially adapted to the manufacture of bread and other articles of food. (A com.)
2351. W. Woofe, Gloucester—Imp. in implements for tilling the soil, and in means of drawing ploughs and other implements for tilling through the land.
2352. T. Marshall, 12, Gate street, Lincoln's-inn-fields, and W. Marshall, 200, Regent-street—Metallic instruments to be used as substitutes for bristles in sewing, stitching, closing, and otherwise joining boots, shoes, and other leather work.
2353. E. Dronke, Oldhall-street, Liverpool—An improved mode of manufacturing gunpowder suitable for war, mining, and general purposes. (A com.)
2354. W. G. Helsby, Liverpool—Imp. in mounting or setting transparent photographic pictures.
2355. A. Firth, Bradford—Imp. in furnaces for heating wheel hoops, applicable also for other similar purposes.
2356. J. Webster, Lee-crescent, Birmingham—Imp. in utilising the waste flux from galvanising works.
2357. J. Sturgeon, Leeds—Imp. in machinery for cutting and boring coal and rocks.
2358. W. Oxley, Manchester—Imp. in pickers for looms.

Dated 25th September, 1863.

2363. A. V. Newton, 66, Chancery-lane—An improved joint for the tubes of surface condensers. (A com.)
2364. P. Spence, Manchester—Imp. in the production of sulphocyanide of ammonium and other sulpho-cyanides.
2365. E. Lloyd, Dee Valley, near Corwen, Merionethshire—Imp. in rotary engines to be worked by water, steam, air, and other motive power.
2366. M. Schaffhauser, Cernay, France—Imp. in the machinery for making paper tubes used in spianing manufactories.

Dated 26th September, 1863.

2367. G. Spill, T. J. Briggs, and D. Spill, Hackney Wick—Imp. in the manufacture of driving straps or bands, and of flexible tubes or hose.
2368. W. T. Rowlett, 90, Welford-road, Leicester—Imp. in crinolines and hooped skirts.
2369. R. Clarke, Altringham, Cheshire—A new application of material for covering crinolines, and in the manufacture of the said material.
2370. W. Clark, 53, Chancery-lane—An improved fabric for the production of permanent electricity, applicable for wearing apparel. (A com.)
2371. J. Spence, Portsmouth—An improved plastic composition, applicable to the coating of metallic and other surfaces.
2372. A. Gleerup, Jewry-street—An improved construction of gas burner. (A com.)
2374. W. Malan, Walpole-street, Deptford, Kent, and W. Tice, Downham-road, Islington—Imp. in apparatus for supplying gas to railway carriages and other moving structures, and in apparatus for manufacturing and holding gas in ships and other vessels, parts of such apparatus being also applicable for manufacturing and holding gas elsewhere.

Dated 28th September, 1863.

2377. L. J. J. Jean, 22, Quai de l'Ecole, Paris—Imp. in the construction of steam boilers, and in their fire-grates.
2378. P. Bourchani, 14, Rue Geoffroy-Marie, Paris—An improved wax-light or candle stand.
2379. P. Cato, Liverpool—Imp. in the construction of combined iron and timber ships.
2380. J. T. Harlow, Upper Saltley, near Birmingham, and E. Harlow, Balsall Heath, Worcestershire—Imp. in breech-loading fire-arms.
2381. W. E. Gedge, 11, Wellington-street, Strand—Improved apparatus for heating by means of illuminating gas. (A com.)
2382. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of boot and shoe toe pieces or tips, and in the machinery or apparatus. (A com.)
2384. G. Thomas, 50, Chichester-villas, Kilburn-park—Imp. in Louvre shutters and Venetian blinds.

Dated 29th September, 1863.

2385. F. Preston, Manchester—Imp. in machinery for rolling and cutting files and rasps.
2386. F. G. Mulholland, 36, Essex-street, Strand—Imp. in the mode of manufacturing submarine telegraph cables, in apparatus connected therewith, and in the method or principle of laying the same, and in the preparation of the several compounds described for electric insulation and other purposes.
2387. S. Mendel, Manchester—Imp. in the manufacture of woven fabrics, applicable to covering telegraph wires.
2388. H. Haigh and R. Heaton, Milns-bridge, near Huddersfield—Imp. in dyeing cotton or other vegetable fibrous substances.
2389. W. Clark, 53, Chancery-lane—An imp. in the soles of boots and shoes. (A com.)
2390. W. E. Gedge, 11, Wellington-street, Strand—Imp. in parts of the permanent way of railways. (A com.)
2391. J. Cooper, St. Margaret's-green, Ipswich—Imp. in the construction of harrows.
2392. P. Llewellin, J. Llewellin, and J. W. James, Bristol—Imp. in water-closets.

Dated 30th September, 1863.

2393. J. J. Chidley, 11, Glaskin-street, Hackney—An improved bottle and stopper.
2394. W. Clark, 53, Chancery-lane—Imp. in musical instruments. (A com.)
2398. G. Elliot, Betley-hall, Staffordshire—Imp. in props and supports for coal and other mines.
2399. B. Browne, 49, King William-street, London-bridge—An improved sight-piece for rifles. (A com.)

Inventions with Complete Specifications Filed.

2397. E. W. Bullard, Massachusetts, U.S.—A new and useful machine or carriage for turning and spreading hay, and for other useful agricultural purposes.—30th September, 1863.
2401. J. Mackay, Aigburth, Lancashire—Certain imp. in fire-arms, ordnance, and projectiles.—1st October, 1863.

Patents Sealed.

[*From Gazette, October 9th*, 1863.]

9th October.

917. D. Mylrea.
920. W. Clark.
921. P. P. Baly.
922. A. F. Maclure.
931. M. Myers.
932. T. Mallinson and P. Williams.
935. G. T. Smith.
940. R. A. Brooman.
941. R. A. Brooman.
943. J. Leach.
945. T. Gray.
946. W. Clark.
949. W. Spence.
950. H. Eaton.
956. I. Baggs and W. Simpson.
959. W. Oldfield.
960. A. Samuelson.
963. R. Knight.
966. J. Goucher.
967. R. C. Clapham.
972. C. W. Siemens and F. Siemens.
976. G. A. Buchholz.
981. C. Blanc.
984. E. W. Hughes.
993. H. Donald.
998. F. E. Bryant.
1000. F. Durand.
1009. R. Richardson.
1027. J. H. Johnson.
1029. L. de Breanski.
1074. S. S. Marling.
1081. H. Worms.
1094. J. H. Johnson.
1095. J. M. Gray.
1115. J. H. Johnson.
1156. W. Clark.
1185. J. Shanks.
1242. H. Bennett.
1247. J. Beaumont.
1360. V. Baker.
1445. W. Wells and J. W. Myers.
1778. H. Mege.
2020. P. F. L. B. Him.
2069. J. Fleming.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October 13th*, 1863.]

5th October.

2462. C. Wheatstone.
2468. R. Hornsby, jun.
2471. T. Whitby & W. Dempsey.
2499. J. J. Russell & B. L. Brown.

6th October.

2429. D. Cope.
5460. J. Ramsbottom.

7th October.

2442. E. Gardner.
2445. J. Edge.
2534. R. G. McCrum.
2792. J. S. Crosland.

8th October.

2457. G. Bonelli.
2501. J. Higgins and T. S. Whitworth.
2989. H. Jordan.

9th October.

2478. W. Barker.
2548. W. Andrews.

10th October.

2574. J. Wadsworth and J. Wadsworth.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, October 13th*, 1863.]

6th October.

2352. F. Whitchead.
2358. D. Joy and W. Holt.

7th October.

2405. T. Allen.

List of Designs of Utility Registered.

No. in the Register.	Date of Registration.	Title.	Proprietor's Name.	Address.
4579	Sept. 18.	The Chest, Back, and Spine Protector	Henry Gaball	7, Burlington-gardens. W.
4580	,, 24.	Design for Improvements in Lamps, for Burning Mineral Oils	J. S. Thomas and Co.	163, Fore-street, Exeter.
4581	,, 28.	Improved Water Tire Iron	Joseph Kenney	Birkenhead, Chester.
4582	,, 30.	Improved Wing Cape or Sleeve Cloak	H. J. and D. Nicoll	Regent-street, W.
4583	Oct. 6.	Handle for Carpet Bags, Portmanteaus, and other articles	James Parkes	Handsworth, Birmingham.
4584	,, ,,	Improved Brace Buckle	Charles Bowley	Newhall-street, Birmingham.
4585	,, 9.	Hooks for attaching Spark and Crinoline Guards for Fire Grates	Thos. Pinfold Hawkins	Birmingham.